BEEF CATTLE AND THEIR ADAPTATION TO VARIOUS AREAS OF THE WORLD 1/

by

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David Fairchild, who was preminent among our early plant explorers, summed up his experiences in a book entitled "The World Was My Garden" (1). For the duration of this paper, I should like to make the world my barnyard, and to discuss the many types and breeds of cattle in that barnyard.

In the five to six thousand years since cattle were first domesticated on the hilly, grassy, open-forested flanks of the Near Eastern mountain ranges (Reed, 1959), cattle have spread over the globe in the service of man. And, either under man's guiding hand or by accident of nature, a host of types and breeds has emerged. Among these types and breeds, some have found their place in the lush pastures of the well-watered portions of the temperate zones; others have adjusted to the hot, humid weather and the coarse feed of the tropics; still others serve man in the cold highlands and well into the northern and southern latitudes. Some are specialized for dairy production, others for beef. The dual purpose animal has also found its place for the combined production of beef and milk. In many areas, triple purpose animals have been the primary type, providing man with milk, meat and draft power. In still other areas, where religious taboos prohibit the eating of beef, the emphasis has been on animals for draft or for milk production or for a combination of these two functions.

The world distribution of cattle is shown in Figure 1. Although the data upon which this map is based are for the 1946-48 period, they are sufficiently recent to indicate the overall pattern. The areas of heavy concentration are in India and Pakistan, northwestern Europe, a portion of Argentina and Uruguay, southeastern Brazil and the north central portion of the United States. Moderately heavy concentrations are also found in northwestern Venezuela and Colombia, in Central America, in South Africa, in East Africa, in New Zealand and along the east coast of Australia, in Thailand, Burma and China, and in southeastern Europe and the European portion of the U.S.S.R.

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In the subject of this paper, the accent is on beef cattle, but one can hardly discuss beef production around the world without taking into account the whole cattle population. For in only a few countries is there a specialized beef industry as we think of it in the United States. In many parts of the world, beef is only a secondary product in relation to other purposes for which cattle are used. Even in the United States our worn-out dairy cows do not go to waste. In northwestern Europe, many of the cattle serve a dual purpose and much of the meat is from veal calves and discarded dairy cattle. In southeastern Europe, veal calves are often kept until they are half-grown and most of the beef comes from them and from discarded work cattle and dairy cows. In the U.S.S.R., most of the breeds are dual purpose in type. In southern and southeastern Asia and parts of Africa, cattle serve primarily as a source of draft power. The Hindus of India eat no beef, and the rest of the population in these two large regions eats little beef since from an economic standpoint it is out of reach of most of the people. In the tribal areas of Africa, cattle serve two other important purposes, as bride wealth and as a hedge against really hard times. One tribe, the Masai, follows the unique practice of bleeding their animals so the blood may be used for food and the animals preserved. I shall return later to the uses of cattle, but first, let us examine the cattle of the world, to see just what has emerged since man first managed to bring the wild predecessors of our domesticated cattle under his control.

Broadly speaking, there are two major types of cattle in the world, the humpless cattle of European and Northern Asiatic origin (Bos taurus), and the humped Zebu cattle of southern Asiatic origin (Bos indicus). The map in Figure 2 shows the approximate distribution of these two basic types and of the intermediate types.

Figure 1. Map showing the distribution of cattle in the world as of 1946-48.

Figure 2. Map showing the approximate distribution of the two major basic types of cattle, i.e., European-type humpless cattle (Bos taurus), and Zebu or humped cattle (Bos indicus), and of the intermediates between these two basic types.

In such a generalized map, only the prevailing type in each area can be shown. Even this is difficult, particularly for areas such as those in which Zebu are shown as has having been recently introduced, i.e., within the last 50 to 75 years or so, for in some portions of the areas so marked, humpless European-type stock no doubt still prevail. Also, some intermediate types have no doubt developed in these areas.

Boundaries between types are only approximate since, in many areas, precise information is either not available or is not at hand to indicate precisely where dividing lines should be.

No attempt has been made in this map to show distinctions in types of production since two or more production types often co-exist within either of the basic types or the intermediates.

For these several reasons the map is limited to a portrayal of the distribution of the basic and the intermediate types. Granting some errors in the placement of the borderlines between types, it does give a good picture of the way cattle have found their way around the world in the service of man.

Several factors have no doubt affected the way in which the present distribution came about.

It is easy to understand how the European-type humpless cattle spread over the land masses of Europe and Asia, and into northern Africa. It is also easy to see how the Zebu cattle found their way into Southeastern Asia and on to the islands of the South Pacific. Intermingling of the two types also took place, quite naturally, wherever they came in contact across Asia and the Near East. Both Zebu and intermediate types apparently found their way across the present land bridge between Asia and Africa and quite probably across the former land bridge at the southern end of the Red Sea. Many migrations of African tribes, further crossing between the two types, and the formation of new breeds in areas of geographic isolation, have no doubt contributed to the rather curious distribution of basic types and intermediates in Africa.

European breeds were taken by European settlers to the new lands--North America, South America, Australia and New Zealand, and they still dominate the livestock scene almost entirely in most portions of these regions of the world. However, in recent times, Zebu cattle have come to occupy major places in the cattle industries in our Gulf Coast region, in portions of Latin America, and in Northeastern Australia.

In general, we have come to regard the European breeds as being adapted to temperate climates, and the Zebu breeds as being adapted to the tropics and subtropics. Although the search for the basic reasons for the physiological differences in the reactions of Zebu and European cattle to heat and other environmental factors is only just beginning, it is clear that real differences do exist. On the other hand, there are substantial variations within each basic type in ability to withstand climatic conditions of different kinds. Also, among the many intermediate types and breeds that have evolved from interbreeding of European and Zebu types, there are no doubt many combinations of the characteristics contributed by the two basic types.

So the distribution of types in the tropical and subtropical portions of the world, as set out in Figure 2, reflect in large part natural migrations of men and cattle along overland routes, overseas migrations of men in which they took with them the kinds of cattle available in their native lands, and the presence of Zebus or types with substantial portions of Zebu blood in most tropical and subtropical areas except those portions of the American tropics where descendants of early Spanish cattle still prevail. Thus, while the distribution pattern reflects the generally superior adaptability of Zebus to hot climates, other factors have contributed to the development of that pattern.

Relatively few of the types and breeds of cattle of the world have found a place in the United States. The Aberdeen Angus, Hereford, Shorthorn, Holstein Friesian, Jersey, Guernsey, Ayrshire, and Brown Swiss are well known. Others such as the Galloway, Devon, Red Poll, and Red Danish are known to a lesser degree. More recently the Charollais has made its appearance. Also, several Zebu breeds including the Kankrej, Ougole and Gir contributed to the formation of the Brahman and the Santa Gertrudis, and the Red Sindhi has been used experimentally in recent years. But these are only a few of the recognized breeds and types in the world.

Figure 3 contains a map showing the approximate points of origin of the major breeds and many of the minor breeds of cattle. The Zebu breeds in India and Pakistan listed are those described by Joshi and Phillips (2). The African types and breeds are those described by Joshi, McLaughlin and Phillips (3). Types shown as originating in China and Mongolia are described by Phillips, Johnson and Moyer (4). Breeds originating in the U.S.S.R. are those described by Novikov, Startsev and Arzumanian (5). For the most part the other breeds shown on the map, are those listed for the respective countries by Mason (6).

I do not wish to enter into any discussion or controversy as to what constitutes a breed. Among the 195 breeds and types shown on the map, there are no doubt some which may not qualify as distinct breeds. On the other hand, the listings are not all-inclusive and some have been omitted which might well qualify as breeds. For example, only 8 breeds are shown as originating in Italy, yet a recent publication (7) describes 23 breeds and local types that are native to that country. Also, in several instances a number of more or less distinct breeds are covered by a single number. What I wish to emphasize here is the great number of types and breeds of cattle that do exist, and which have evolved either by accident of nature or under man's guiding hand.

It is hardly possible here to discuss or even mention all the 195 breeds referred to in Figure 3. However, I shall refer briefly to those originating in certain areas and to some other breeds that may be of greatest interest.

The Brahman breed of Zebu, which has evolved in the Gulf Coast region, is well known so I shall begin by referring briefly to the Zebus of India and Pakistan, the area from which all Zebu blood originally came.

Six major groups are recognized. Group I includes five breeds, all characterized by lyre horns, gray coloring, wide foreheads, prominent orbital arches and thin faces with flat or dished-in profiles. One breed is the Kankrej which was probably the main contributor to the Brahman. Another is the Tharparkar (Figure 4).

Group II includes nine breeds of shorthorned, light gray or white cattle, with long coffin-shaped skulls, with orbital arches that are not so prominent, and faces that are slightly convex in profile. The Krishna Valley breed (Figure 5) of this group made some contribution to the Brahman.

Figure 3. Map showing the approximate places of origin of most of the breeds of cattle of the world. Some, while not fully recognized as breeds, are distinct local types. In other cases, more than one breed is covered by a number. The numbers shown on the map correspond to the numbers for the respective breeds set forth below.

Europe

Scotland: 1 - Aberdeen - Angus; 2 - Galloway; 3 - Highland; 4 - Ayrshire.

Ireland: 5 - Dexter; 6 - Kerry.

Wales: 7 - Welsh Black.

England: 8 - Hereford; 9 - Beef Shorthorn; 10 - Devon; 11 - Sussex; 12 - Dairy Shorthorn; 13 - Lincoln Red Shorthorn; 14 - Red Poll; 15 - South Devon.

Channel Islands: 16 - Guernsey; 17 - Jersey.

Iceland: 18 - Iceland.

Norway: 19 - Red Polled Østlan; 20 - Black - sided Trondheim and Nordland; 21 - Telemark; 22 - South and West Norweigen (Including Lyngdal, Vestland Polled, Vestland Fjord); 23 - Døle; 24 - Red Trondheim; 25 - Norweigen Red-and-White.

Sweden: 26 - Swedish Red-and-White; 27 - Swedish Polled.

Finland: 28 - Finnish.

Denmark: 29 - Red Danish; 30 - Black-Pied Danish (Including Black-Pied Jutland, Friesian).

Germany: 31 - Yellow Hill (Including Franconian, Glan-Donnersberg, Lahn, Limpurg); 32 - German Brown (Including Allgau, Murnau - Werdenfels); 33 - German Red (Including Bavarian Red, Harz, Odenwald, Sechsamter, Siegerland, Silesian Red, Waldeck, Vogelsberg, Vogtland); 34 - Small Spotted Hill (Including Hinterwald, Vorderwald); 35 - Black-Pied Lowland (Including East Friesian, East Prussian, Jeverland, Wesermarsch); 36 - Red-Pied Lowland (Including Lower Rhine, Red-Pied East Friesian, Breitenburg, Wilstermarsch, Red-Pied Westphalian); 37 - Red East Friesian; 38 - Angeln.

Netherlands: 39 - Holstein - Friesian; 40 - Groningen.

Belgium: 41 - Blue; 42 - Red West Flemish; 43 - East Flemish Red Pied, 44 - Campine; 45 - Herve.

France: 46 - Normandy; 47 - Charollais; 48 - Eastern Red Pied; 49 - Limousin; 50 - Maine - Anjou; 51 - Parthenay; 52 - Gascony; 53 - Salers; 54 - Aubrac; 55 - Armorican; 56 - Blond Pyrenian; 57 - Breton Black-Pied; 58 - Garonne.

Spain: 59 - North Spanish (Including Galician, Asturian, Leonese, Santander, Pyrenean); 60 - Central and Southern Spanish (Including Alvia, Extremadura, White Caceres, Marucho, Murcian, Serrana, Zamora, Andalusien); 61 - Toro de Lidia.

Portugal: 62 - Portuguese (Including Alemtejo, Aroucesa, Bajocara, Borrosa, Jarmelo, Minho, Miranda, Ribatejo, Turino).

Switzerland: 63 - Brown Swiss; 64 - Simmental; 65 - Herens; 66 - Fribourg.

Austria: 67 - Pinzgau; 68 - Light Alpine (Including Murboden, Blond, Waldviertel); 69 - Brown Mountain; 70 - Oberienntal.

Italy: 71 - Chiana; 72 - Romagnola; 73 - Marche; 74 - Maremma; 75 - Piedmont; 76 - Modena; 77 - Grey Alpine; 78 - Grey Adige.

Poland: 79 - Polish Red.

Hungary: 80 - Hungarian Red Spotted; 81 - Hungarian Steppe.

Romania: 82 - Romanian Steppe; 83 - Romanian Mountain.

Yugoslavia: 84 - Busa; 85 - Yugoslav Steppe.

Albania: 86 - Albanian

Greece: 87 - Greek Shorthorn.

U. S. S. R.

88 - Kholmogor; 89 - Tagil; 90 - Aulie-Ata; 91 - Yaroslavl; 92 - Ukranian Red; 93 - Latvian Red; 94 - Suksun; 95 - Ukranian Whitehead; 96 - Gorbatov Red; 97 - Yurino; 98 - Istoben; 99 - Siberian; 100 - Pechora; 101 - Caucasian; 102 - Kostroma; 103 - Tambov; 104 - Bestuzhev; 105 - Ukranian Grey; 106 - Kalmyk; 107 - Kirgiz.

Central and Eastern Asia

108 - Mongolian; 109 - Tibetan; 110 - Chinese Yellow (Including North China and South China types, with variations in each type); 111 - Korean; 112 - Japanese.

Near East

113 - Anatolian (Including Black and Red); 114 - Persian; 115 - Iraqi; 116 - Oksh; 117 - Kurdi; 118 - Jaulan.

India and Pakistan

119 - Kankrej; 120 - Kenwariya; 121 - Kherigarh; 122 - Malvi; 123 - Tharparkar; 124 - Bachaur; 125 - Bhagnari; 126 - Gaolao; 127 - Hariana; 128 - Krishna Valley; 129 - Mewati; 130 - Nagori; 131 - Ongole; 132 - Rath; 133 - Dangi; 134 - Deoni; 135 - Gir; 136 - Nimari; 137 - Red Sindhi; 138 - Sahiwal; 139 - Amrit Mahal; 140 - Hallikar; 141 - Kangayam; 142 - Khillari; 143 - Lohani; 144 - Ponwar; 145 - Siri; 146 - Dhanni;

Southeast Asia and Pacific

147 - Burmese; 148 - Thai; 149 - Thai-Kedah; 150 - Sumatran; 151 - Indonesian; 152 - Sinhala.

Africa

153 - Egyptian (Including Damietta, Baladi, Saidi, Maryuti); 154 - Libyan; 155 - Brown Atlas; 156 - Adamawa; 157 - Azaouak; 158 - Maure; 159 - Northern Sudan; 160 - Shuwa; 161 - Sokoto; 162 - Nigerian Fulani; 163 - Senegal Fulani; 164 - Sudanese Fulani; 165 - White Fulani; 166 - M'Bororo; 167 - N'Dama; 168 - West African Shorthorn; 169 - Kuri; 170 - Ankole; 171 - Barotse; 172 - Basuto; 173 - Nguni; 174 - Nilotic; 175 - Nioka; 176 - Nganda; 177 - Tonga; 178 - Angoni; 179 - Boran; 180 - Bukedi; 181 - Galla; 182 - Lugware; 183 - Nandi; 184 - Southern Sudan Hill; 185 - Tanganyika; 186 - Toposa - Murle; 187 - Africander; 188 - Madagascar.

The Americas

189 - Brahman; 190 - Santa Gertrudis; 191 - Romo Sinuano; 192 - Blanco Orejinegro; 193 - Indubrazil; 194 - Caracu; 195 - Jamaica Hope.

Figure 4. A Tharparkar cow, native to Pakistan. (Indian Council of Agricultural Research photo).

Figure 5. A Krishna Valley cow, native to India. Although this animal is thin, the depth and blockiness of the body are evident. (Indian Council of Agricultural Research photo).

Group III is composed of six breeds of more ponderous build. They have pendulous dewlaps and sheaths, prominent foreheads and lateral and often curled horns. Colors are usually spotted red (of various shades) and white, or solid red, dun or brown. The Gir, in this group, made some contribution to the Brahman and was a major contributor to the Indubrazil. Another breed, similar in appearance, is the Deoni (Figure 6) which has evolved during the last 200 years from an admixture of Gir, Dangi and local cattle in its native district. The Sahiwal (Figure 7) was crossed with the Jersey to form the base for the Jamaica Hope, and the Red Sindhi (Figure 8) has been used experimentally in the United States in recent years, particularly in crosses with the Jersey. Generally, the best milk producers among the Indian and Pakistani Zebus are found in this group.

Group IV, consists of the so-called Mysore cattle of southern India. They are medium in size, compact, have tight sheaths and are strong, active animals. Pointed horns emerge from the top of the poll and extend upward and backward. Of four major breeds and two minor strains, the Kangayam (Figure 9) has been the object of the most breeding-improvement work.

Figure 6. A Deoni bull. Native to India, this breed evolved from crosses of Gir, Dangi and local cattle. (Indian Council of Agricultural Research photo).

Figure 7. A Sahiwal cow. Native to Pakistan, this is, on the average, the best milking breed among the zebus. Also, it is one of the lowest, thickest set breeds.

Figure 8. A Red Sindhi cow. Native to Pakistan, the breed is smaller than the Sahiwal, but it is also one of the best milk producers among the Zebus. (Indian Council of Agricultural Research photo).

Figure 9. A Kangayam cow. This is one of several breeds of southern India which are often referred to as Mysore cattle. It was developed on the estate of the Pattigar of Palayakottai near Coimbatore. (Indian Council of Agricultural Research photo).

Group V is made up of several small and quite varied breeds found in the mountainous and forested tracts of India and Pakistan. They are red, dun or black in color with white markings, and horns may be either short or somewhat lyre-shaped. One of these, the Ponwar, is very similar to the Madagascar Zebu which Tristan d'Acunha found in large numbers when he discovered the island (now the Malagasy Republic) in 1506.

Group VI contains only one breed, the Dhanni (Figure 10). These animals, much prized for draft purposes, are medium-sized, compact, active, and have tight sheaths and dewlaps. In color, they usually have black or red spots on a white coat, the spotting pattern often being similar to that of the Dalmatian dog.

Africa is very much in the news these days as many newly independent countries emerge and as old tribal conflicts boil to the surface. However, the extent to which a wide variety of cattle types and breeds has evolved on that continent is not well known. It is difficult to arrive at a logical classification of African cattle owing to lack of adequate information in many cases, and because several of the breeds are intermediate between Zebu and non-humped cattle. However, they may be placed in eight groups.

Group I includes the humpless or vestigially-humped cattle of the lower Nile Valley and Mediterranean Africa--three breeds in all, one of which has four recognized sub-types.

Group II includes the Zebus of the subsaharan zone. There are 11 breeds. Some are medium and short-horned, while others are lyre and long-horned.

Group III includes two humpless, straight-backed breeds of West Africa.

Group IV has only one breed, the Kuri (Figure 11) of the Lake Chad area.

Figure 10. A Dhanni bull, native to northwestern Pakistan, these cattle are much prized for draft purposes.

Figure 11. A Kuri cow. These cattle are native to the Lake Chad area of Central Africa.

Group V includes the cattle of much of central and southern Africa from the flood plain of the Nile in the Sudan to Swaziland and Basutoland. They are characterized by large or medium-sized lyre-shaped horns, small or vestigial humps and moderately sloping hindquarters. Among the eight breeds are the Ankole (Figure 12) and Nguni (Figure 13).

Group VI includes nine types which form a large, heterogenous population in Eastern Africa, with the breeds often merging into one another. All are predominately Zebu in type. Examples are the Boran (Figure 14) and the Galla or Jiddu (Figure 15).

Group VII includes only the Africander. This is probably the only African breed that has ever been tried, even on a limited basis, in the United States.

Group VIII also includes only one breed, the Madagascar Zebu, to which reference has already been made.

In view of the interest of this Short Course in crossbreeding, it is worth noting that 10 of the 36 African breeds have evidently emerged as a result of crossing between Zebu and European-type cattle. These are the eight breeds in Group V, the Egyptian cattle of Group I, and the Africander.

Another region of much current interest to us in the United States is the U.S.S.R., but here too, we know little of the cattle of this great land mass which stretches across part of Europe and all of Asia.

Figure 12. An Ankole cow. This breed is native to Uganda and adjacent areas of East Africa. The horns of this animal measured 52 inches between the tips. (Photo from Department of Information, Uganda Protectorate).

Figure 13. A Nguni cow, native to Swaziland, Zululand and southern Mozembique.

Figure 14. A Boran bull. This breed is found in Kenya and adjacent parts of East Africa. (Photo by Miles Fletcher).

Figure 15. A Galla or Jiddu bull, native to Somalia and adjacent parts of East Africa.

There are twenty breeds that originated in the U.S.S.R., of which at least fourteen have emerged from crossbred or multi-cross foundations. Most of the Russian breeds are of dairy and dual purpose types. Examples of the dairy and dual purpose types are the Kholmogor, Tagil, Yaroslavl (Figure 16), White-headed Ukranian, Kostroma (Figure 17), Bestuzbev and Red Tambov. Some Holstein blood went into the formation of the Kholmogor, Tagil, Yaroslavl and five other black-and-white Russian breeds. The Tagil is based on a very heterogenous foundation, including Kholmogor, Holstein, Brown Swiss, Shorthorn, Tyrol, Yaroslavl, Simmental, Ukranian Gray, Kalmyk and Kirgiz, the first two having had the greatest influence. The Yaroslavl is also based on a mixture including Kholmogor, Tyrol, Holstein, Brown Swiss, Simmental, Jersey and Angeln.

The Ukranian Gray or Gray Steppe (Figure 18) is one of the most ancient Russian breeds. These cattle are used for work, meat and milk, and have left their mark on several of the breeds of southern Europe and Spain, and probably also on the Blanco Orejinegro cattle of Colombia.

Only two Russian breeds, the Kalmyk or Red Astrakan (Figure 19) and the Kirgiz or Kazakh (Figure 20) are regarded primarily as beef animals. One curious feature of the Kalmyk breed is the manner in which the horns emerge close together at the top of the head. In this respect they are similar to the several breeds of the Mysore type in Southern India. This same characteristic is found among some of the cattle of Sinkiang Province in Northwestern China. Both the Kalmyk and Kirgiz breeds evolved in areas adjacent to the border of China and Outer Mongolia.

Figure 16. A Yaroslavl cow. This is one of seven black-and-white breeds in the U.S.S.R. that show substantial evidence of Holstein-Freisian blood.

Figure 17. A Kostroma cow. This U.S.S.R. breed is of dual purpose type and shows evidence of Brown Swiss blood, which was one of several breeds that influenced its development.

Figure 18. A Ukranian Gray or Gray Steppe cow. These are essentially triple-purpose animals.

Figure 19. A Kalmyk or Red Astrakan cow. Native to central Asia, this is one of two U.S.S.R. breeds that are of beef type.

Figure 20. A Kirgiz or Kazakh cow. This beef breed, like the Kalmyk, is native to central Asia.

The so-called Yellow Cattle of southern China (Figure 21) provide an example of a type which has evolved as a result of intermingling of humped and non-humped cattle. These cattle, which are used primarily for draft, have small to medium-sized humps, and there are marked variations from area to area in general conformation and coloring. North of the Tsingling Mountains, the Yellow Cattle are more apt to be some shade of red, the hump is either very small or usually entirely lacking, and they are generally larger than the cattle in South China. As with the cattle of the South, there are substantial variations from area to area.

I shall not dwell on the European breeds since many of the more important and some of the minor ones are well known. However, note should be taken of a few of the less known breeds which have some outstanding characteristics either of productivity, or adaptability.

In the far North of Europe, the Finnish cattle are of special interest. These attractive dairy animals perform well in the northern latitudes. In color, they are similar to the Guernsey, but they are somewhat smaller and differ somewhat in general conformation.

Another breed from the northern latitudes of Europe is the Scotch Highland (Figure 22). These picturesque beef animals thrive in the cool damp highlands but have been used to only a very limited extent outside their native Scotland.

Two breeds from the central latitudes of Europe, and which are of special note, are the Charollais and the Simmental. These are two of the largest breeds of cattle, and both appear to have quite rapid growth rates, although few figures are available to us.

Figure 21. A Yellow cow of China. This cow, native to the Chungking area, is intermediate to the Zebu and European types, as are other cattle south of the Tsingling Mountains. North of the Tsingling Mountains the cattle show little or no evidence of Zebu blood.

Figure 22. Highland Cattle of Scotland.

The Charollais (Figure 23), which originated in central France, reaches average weights of 2300 to 2400 pounds for bulls and 1700 to 1800 for cows. In their native home, where they are used both for work and beef, they are raised and fattened largely on grass, and in winter they are stall-fed hay, straw and roots. Few concentrates are fed.

The Simmental (Figure 24) of western and northwestern Switzerland is used for meat, milk and work. Mature bulls weigh from about 2,100 to 2,500 pounds and cows average about 1,600 pounds. They are usually maintained on high mountain pastures in summer, and in villages in winter where they are fed silage, hay, root crops and (for milking cows and fattening cattle) concentrates. Average production of 75,000 cows tested from 1935 to 1945 was about 8,900 pounds of milk in 300 days. They have found wide acceptance in some other European countries, including the U.S.S.R.

A breed from the Mediterranean area that is practically unknown in the United States is the Romagnola (Figure 25) of northern Italy. These animals, which serve primarily to produce draft power and beef, are impressive, massively built beasts. They, and also the Chiana of Tuscany, and the Maremma of the area near Rome, bear the marks of the Grey Steppe cattle from the U.S.S.R. and intervening countries of southeastern Europe.

Figure 23. A Charollais cow native to central France. This cow, aged 5 years, weighed about 2,420 pounds.

Figure 24. A Simmental cow. Native to western and northwestern Switzerland, these are outstanding triple purpose animals.

Figure 25. A Romagnola bull. This breed is native to northern Italy.

Here in the Western Hemisphere the new breeds appear to be the result either of deliberate crossing or of gradual mingling of breeds. The Brahman resulted from the intermingling of several Zebu breeds, of which the Kankrej was probably most important. The Santa Gertrudis was evolved from an Ongole (Nellore)x Shorthorn base. The Blanco Orejinergro (Figure 26) and the Romo-Sinuano (Figure 27) of Colombia emerged from the early Spanish stock, and, in the case of the Romo-Sinuano there was probably some blood from British beef cattle, i.e., Red Poll and/or Aberdeen Angus. The Indubrazil is also the result of intermingling among breeds, and resulted primarily from crosses of Gir and Kankrej. The Caracu of southern Brazil (Figure 28) evolved from European cattle but its history is not clear. However, the color suggests that a breed such as the Blond Pyrenian may have contributed to its development. The Jamacia Hope originated from crosses of Sahiwal and Jersey, but, as a result of back-crossing, the Jersey has made the larger contribution to this new breed.

If we could trace back from all present day types of cattle to their ancestral roots in the original domestications, we would have a fantastically intricate story - intricate in respect of man's own migrations and the ways in which cattle were associated with him in those migrations - intricate in the way the multiplicy of breeds reflects many separate lines of development under widely differing environmental conditions and the intermingling of types and breeds emerging from these separate lines of development. Here is a story that may be as intricate as man's own history, and, in any event, is a story closely related to that of man's recent development. I say recent, because the period since cattle were domesticated, i.e., the last 5,000 to 6,000 years, is short indeed compared with the 600,000 or more years since Nutcracker Man and his predecessor first emerged as beings with something more than animal intelligence, i.e., the ability to fashion and use tools. But much of that story can never be written because many of the basic facts were never recorded. Even now, our knowledge of the world's cattle is remarkably scant. Only in recent years have serious efforts been made to bring together comprehensive information regarding the cattle in some of the major regions of the world (2,3,4,5,), or even to prepare lists of the breed names used in the various countries (6). If we consider how little we know about the cattle of the world, and agree that cattle constitute the most important single class of livestock serving man, yet contemplate how much is being spent to explore outer space, one is inclined to suggest a new version of an old slogan, "See the world first".

In this connection, I should like to quote a paragraph from a paper (8) given somewhat over a year ago before the American Association for the Advancement of Science:

> It is clear that our animal breeders have made substantial progress in the development of more productive breeds and strains, making use of the stock that has been available to them. It is also clear that a very large segment of the animal germ plasm available in the world has not been used in the development of our livestock and poultry industries. It is not clear, however, just how much we might profit from the use of germ plasm from these untapped reservoirs. Here is a largely unexplored field of scientific endeavor. Exploration of it would no doubt yield a lot of negative results, but there are possibilities of positive results that could be of considerable benefit to our livestock industry and to the well-being of our people. We are inclined to think we have the best, not only in livestock but also in many other things. However, it is hardly reasonable to assume that somehow, all the best germ plasm was concentrated in those areas from which our foundation stock came.

I venture to suggest that this comment about our livestock and poultry as a whole, applies particularly to cattle, and I hope that in the material presented thus far, I have been able to give some small indication of the great variability that exists in the cattle of the world - variability in size, form, adaptability and productivity.

Figure 26. A Blanco Orejinegro cow. This breed is native to Colombia.

Figure 27. A Romo Sinuano cow. This breed is native to Colombia.

Figure 28. A Caracu bull. This breed, originating from Spanish stock, is native to southern Brazil.

At the beginning, I commented briefly on the ways in which man uses his cattle. I should now like to pursue this a little further, for, just as there are variations in cattle, there are also wide variations in the extent to which man uses cattle and harvests products from them. These variations are emphasized by the data shown in chart form in Figure 29. Australia and New Zealand, taken together, have 1.94 cattle per person, compared with 0.55 in the United States, 0.18 in Asia exclusive of the U.S.S.R., and 0.31 for the world as a whole exclusive of the U.S.S.R. The amount of beef and veal harvested per person per year varies from 201.8 pounds in Australia, to 92.3 pounds in the United States, 4.8 pounds in Asia and 22.0 pounds for the world. For milk, sample figures are 2,142 pounds per person in Australia and New Zealand, 1,060 pounds in Canada, 750 in the United States, 25 in Asia, and 206 for the world. These, and the data upon which Figure 30 is based, are from FAO (9). For Europe, the charts in both Figures 29 and 30 bring out the emphasis placed on dairy rather than beef production, compared with the United States and Canada. Also, both charts emphasize the very low productivity, in terms of meat and milk, in an area such as Asia where cattle are used primarily for draft purposes.

In Figure 30, the chart shows the productivity per animal in various countries and regions. Such a chart cannot tell the whole story of relative levels of productivity among countries and regions. Census data for most countries are not broken down to show the numbers of beef and dairy animals, or the number of oxen used for work, or the extent to which cows may be used for milk and/or work and eventually slaughtered for beef. But the chart does give an overall picture of how much meat and milk is produced per animal in the cattle population. For the world (exclusive of the U.S.S.R.) the amount harvested annually per animal is 70.1 pounds of beef and veal and 655 pounds of milk. The countries and regions are arranged according to level of production of beef and veal. The United States ranks first in this grouping, with 166.7 pounds while Asia is last with 26.2 pounds. For milk, Europe ranks first with 2,419 pounds while Asia is last with 140 pounds. It must be emphasized that these are generalized comparative estimates of productivity, not estimates of the productivity of a specialized dairy cow or of a beef animal in the respective countries or regions.

Figure 29. Chart showing the cattle per person in various countries and regions, and also the average annual "harvest" of beef and veal, and of milk for each person from those cattle. No account is taken in these data of exports and imports of livestock products.

Figure 30. Chart showing the average annual "harvest" of beef and veal, and of milk, per animal in various countries and regions.

While discussing milk production, it is perhaps worth noting that cattle contribute 90 percent of the world's milk supply. The other 10 percent is produced by water buffaloes, goats, and sheep, ranking in the order listed.

Although draft power can hardly be measured in the same precise terms as meat and milk, and the amount supplied by horses and other animals as compared with cattle is not known, it has been estimated (10,11) that, in 1948-49, 86.4 percent of the world's draft power in agriculture was still supplied by livestock. Percentages for various regions were: Far East - 99.9; Latin America - 99.1; Near East - 98.9; Africa - 98.3; Europe - 85.6; U.S.S.R. - 78.7; Oceania - 62.5; North America - 24.5; United Kingdom - 22.7. Cattle contribute a substantial share of this power.

In conclusion, I should like to emphasize several points. But, first, may I say that I have tried to cover a very broad, complex subject in a short time. In doing so, it has been necessary to generalize a great deal, to omit many important facts that might have been cited, and to by-pass many breeds that might have been discussed. I am very much in the position of J. H. Woodger when he said, "The situation is complicated and the difficulties are enhanced by the impossibility of saying everything at once". But even though I have painted with a broad brush, I hope that I have been able to convey to you the following thoughts:

1. The approximately 868,000,000 cattle in the world constitute a highly varied and complex industry. Man harvests from this industry about 22 pounds of beef and veal and about 206 pounds of milk for each person each year, on the average, together with a great deal of "horse" power, as well as hides and other products. To measure the total average productivity of cattle in another way, it may be said that for each animal in the cattle population there is an average harvest of about 70 pounds of beef and veal, and 655 pounds of milk per year.

2. But, as with any other average figure, these averages are only points around which the populations vary. So there are extremely wide variations in the manner and the degree to which man utilizes cattle and harvests useful products from them in various parts of the world.

3. These variations result from differences in the inherent producing capacities and degrees of adaptability of the cattle, and from differences in climate, feed supplies and management, including the control of diseases and parasites.

4. Over the five to six thousand years since cattle were domesticated, two basic types of cattle - the Zebu and the European - have evolved and spread over large portions of the globe. Although the Zebus have greater adaptability to the tropics, and sub-tropics, and the European type has greater adaptability to the temperate zones, factors other than those inherent constitutional factors which contribute to these differences in adaptability have also contributed to the present pattern of distribution of the Zebu and European types as shown in Figure 2. The most important of these factors were: (a) The natural movements of cattle to contiguous or adjacent land masses; (b) The migrations of people to these same contiguous lands and within areas such as Africa, taking with them the cattle they owned; (c) The overseas migrations of the great navigating peoples, and particularly those of peoples of the British Isles and the Iberian Peninsula who settled the new lands - the Americas, Australia and New Zealand - taking with them the cattle native to their home countries; (d) The natural intermingling of Zebu and European types, where they came in contact in Asia and Africa leading to the development of intermediate types; and (e) The relatively recent importations of Zebus into areas such as northern Australia, Brazil and our own Gulf Coast region, to take advantage of their special adaptability to tropical and sub-tropical conditions.

5. Within both the European and Zebu types, many breeds have emerged, as is evident from the partial listing of breeds and local types in Figure 3. Within each of the basic types, there are breeds specialized for beef and for dairy production, and there are intermediate types that may be dual purpose (beef and milk, beef and draft, milk and draft) or triple purpose (beef, milk and draft).

6. Crossbreeding has played a major role in the evolution of many breeds that are intermediate to the Zebu and European types, but also of many breeds within each of these basic types. Some of this crossbreeding has been by chance while in other cases it has been carefully planned and used as a tool to achieve specific objectives. Wisely used, there is every reason to believe it can be an effective tool in future cattle breeding programs.

7. Of the many breeds and local types of cattle available in the world, few have been used and even fewer have found major places in the livestock industry of the United States. Some of the breeds that have not been used here are known to have some outstanding characteristics, but, on the whole, we have relatively little real factual information about the capacity of most of these breeds to produce. As a country we have long been engaged in plant explorations, searching for new plants and better varieties of established crops. On the animal side, we have been much more conservative. As population pressures increase, as competition between plants and animals for space on the land and a place for their products on our tables becomes more intense, perhaps as a country we shall be forced to become animal explorers as well as plant explorers, in order to ensure to our livestock breeders the best in available germ plasm for use in their efforts to develop animals that are even more productive and more efficient than the excellent stock we now have. Such a program would require a great deal of research, much of it outside the United States, and it would have to be conducted in a safe and sane manner, as I have discussed elsewhere (8). My point here, and my final one, is that we should not shy away from new and imaginative approaches in animal breeding, but rather, we should examine and pursue them on the basis of their merits.

END

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